

ARRL and TAPR

1996 Digital Communications

The Digital Communications Conference was held on September 20-22 in SeaTac, Washington, between Tacoma and Seattle, Washington. The attendance count for the conference was 168 people. This was an increase of 30% from the previous year. It seemed that the conference was well rounded in technical content. When you talked to people after the conference, they commented that HF, DSP, Spread Spectrum, or APRS were the main areas of interest. The nice thing about this year's conference was that all of these and more were focused on at different times of the conference.

The conference was co-hosted by the [Puget Sound Amateur Radio TCP/IP Group](#) and Boeing Employees Amateur Radio Society (BEARS). If it were not for the effort of Tina and Steve Stroh, N8GNJ, of the Puget Sound Amateur Radio TCP/IP group many aspects of the conference would not have been possible. Tina and Steve put in a lot of work on the local issues before and during the conference. Both amateur radio groups contributed towards the very well provisioned hospitality suite.

Friday, September 20th, 1996

The conference began on Friday with the opening of the hospitality suite, even though the TAPR Board and ARRL Future Systems Committee had already had meetings that day. As noted above, attendees visiting the hospitality/registration area had a good selection of munches and drinks, plus lots of space to set up equipment and sit around and discuss projects and plans. Friday afternoon Keith Sproul, WU2Z, held an APRS workshop. 65 people attended the workshop and heard the latest on what Keith and his brother Mark, had been working on. After the workshop, people moved back over to the hospitality area.

Saturday, September 21st, 1996

Saturday morning the conference got an early start at a little past 8:00am when Steve Stroh, N8GNJ, Rod Stafford, KB6ZV (President ARRL), Greg Jones, WD5IVD (President TAPR), and Keith Justice, KF7TP welcomed the conference attendees and kicked off the conference.

As a first ever, the conference audio from the main session was made available via RealAudio over the Internet -- LIVE!. There were a few glitches throughout the day, but overall the comments received were positive. One of the first problems was that the local phone company (US West) had a switch problem that was not corrected until after 9am. The problem had been reported the night before! Once that was corrected, we had an error on the TAPR server that was corrected just after 10:30am. After these two small problems, the feed was pretty much continuous until the encoding computer locked up a little past 4pm, when someone came by and decided they wanted to check their e-mail. The live broadcast had over 200 people connect to listen to the conference throughout the day.

If you couldn't attend the conference, TAPR is making all the main paper session presentations available on

their web site (www.tapr.org) under the [Virtual Conference page](#). The Introductory topic sessions were recorded, but due to local Part 15 device interference (from the several Metricom radios operating in and around the conference) a lot of the audio was lost due to noise hits, one of the problems you sometime run into with Part 15 wireless audio mics. Something for TAPR to fix next conference with better wireless mic devices. In addition to the audio, a full page of images from the conference is available for browsing.

At 8:30am the main paper sessions and the introductory sessions began. The first paper was "[Baseband Group Delay Equalization of IF Filters for Data Communications](#)" by Tom McDermott, N5EG. Tom talked about ways to figure IF filters in receivers. He examined some amplitude, phase, and delay properties of first-order, second-order, and all-pass filters. In addition, he showed several examples of Chebychev and Butterworth IF filers. A very good talk if you are interested about how to make modems work over radios. Much of the talk was based on information being published in Tom's book "Wireless Digital Communications: Design and Theory" being published by TAPR.

Paul Rinaldo, W4RI, followed Tom and presented a paper entitled "[Amateur Radio Digital Voice Communications](#)". However, Paul didn't talk about his paper. He focused his presentation on spectrum policy and current issues that are impacting amateur radio. A very interesting discussion touching on such things as current FCC policy and issues regarding the upcoming WRC. His paper in the proceedings outlined that amateurs need to apply the same energies and talents that made SSB, ATV, packet, and small satellites possible to now make digital voice a reality in the amateur bands. Nothing is keeping amateurs from implementing digital voice communications.

Keith Sproul, WU2Z, presented "[A 9600 Baud modem for the LPT port](#)", submitted by Wolf-Henning Rech, DF9IC, and Don Rotolo, N2IRZ. The talk outlined a simple modem for 9600 Baud FSK which can be connected to a LPT port that has been designed by Wolf-Henning Rech, DF9I. It is powered from the port and does not need any alignment. Several drivers for DOS and Linux are available because of its compatibility to the BayCom PAR96 modem (and its PacComm clones). The design was originally published in the proceedings of the 12th Internationally Packet Radio Conference Darmstadt, 1996.

Craig McCartney, WA8DRZ, then presented "[Constructing a Worldwide HF Data Network](#)". Craig discussed the design and implementation of a HF Digital system that his company had developed for the maritime communications environment. Craig touched on some of the history and then explained the practical guidelines for making such a system work reliably. The system uses Automatic Channel Sounding, Clover, and they have adopted several different ways for interconnecting their worldwide sites together (dedicated dial up, Internet, and others). They should have 15 stations operational by the end of 1996.

The first introduction session strand had Greg Jones, WD5IVD, presenting a 45 minute talk on basic digital communications from an operations standpoint. Greg touched on HF, VHF modes as well as explanations of many of the topics that would be seen during the conference. The talk was very generic and tried to touch on a lot of basic topics. Johan Forrer, KC7WW, then presented an introductory talk on HF digital communications. Johan discussed in detail what was involved and how people operated the HF digital modes. He touched on basic and more advanced aspects of the F digital communications modes. This was the second year that the DCC held an introductory topic session strand. These sessions ran in parallel with the main paper sessions in the adjacent room. The purpose of these sessions was to try to have a more indepth look at specific topics of interest. Based on comments received as of this writing, the Introductory session strand will be present again next conference.

Session 2a (10:30am) was started with a presentation by James Wagner, PhD, KA7EHK, entitled "[Packet and Internet](#)". James' paper looked at the recent debate issues concerning the question of BBS mail forwarding by methods other than the ham RF network. Whichever side proves to be "right", (and it is possible that both

may be right), the answers to this debate will have an impact on all packet users. James discussed these issues and looked at both sides of the issue. He voiced the concern about some of the deterioration of long-haul RF networking due to the ease of access and use of Internet and other wireline based systems.

Tim Bagget, AA5DF, presented a paper regarding the use of Motorola's DSP with regard to HF applications. This talk did not appear in the proceedings. Tim, a recent graduate from New Mexico State, is now working in Austin for Motorola in the DSP group. Tim focused on the DSP used within the Kenwood TS870. The TS870 uses two 56002 DSP and are in-line with the IF of the radio. The radio has 237 selectable IF filters! Tim discussed the implementation and some of the methods of implementation and also discussed the overall family of Motorola DSP processor line. The 56300 core was discussed in detail. The EVM56002 was discussed and Tim touched on the TAPR group purchase and possible future direction with EVM products for amateur applications.

James Wagner, PhD, KA7EHK, presented his second paper entitled "[Strategies for Improving Wide-Area Networks](#)". James' paper covered the topic that wide-area single-frequency networks still cover large areas of this country. While, this might be the low-end solution to networking, it doesn't seem to be going away. A number of strategies have been developed for improving such networks, but these strategies are very slow to be adopted. He discussed some of the reasons for the continued existence of these networks and the strategies and their likelihood of success. How can we use education to try to get changes made in different areas to help support better and faster communications. It was interesting to note some of the comments during the question period that indicated a number of new digital networks seem to be generating systems very similar to what was done in the mid-80's and thus we seem to have lost the link between those efforts 10 years ago and new operators today.

Session 2b of the Introductory Topic session saw presentations by Steve Bible, N7HPR, on Spread Spectrum Communications and Keith Sproul, WU2Z. Steve covered the basics and more advanced concepts of Amateur Radio based Spread Spectrum Communications. There was a lot of interest in this topic, as indicated by the the number of people who couldn't find a chair to sit! The presentation touched on the upcoming directions of Spread Spectrum communications in Amateur Radio. All very exciting. Keith Sproul, WU2Z, presented a 45 minutes condensed version of his normal APRS talk. He hit on all the major aspects of APRS and got to demo the system and his software one more time during the conference. If there had been a prize for most papers given and most equipment moved, Keith would have won it!

The conference then broke for Lunch. Lunch was a sandwich buffet. Near the end of Lunch, Rod Stafford, KB6ZV (President ARRL) and Gerald Knezek, KB5EWV (DCC Student Awards Co-Chair) presented the first annual Student Paper Awards. Rod and Gerald presented checks and plaques to Michelle Toon, KC5CGH, and Marc Normandieu. Michelle received the award for 'best educational or community-oriented application paper by a student' for the paper 'Circus of the Stars'. Marc received the award for 'best technical/theory-oriented paper by a student' for the paper 'Object-Oriented Modeling of a Satellite Tracking Software'. This year's awards were made possible by a donation by the ARRL Foundation, Inc. It was very exciting to see the culmination a year's worth of work. The principle individuals responsible for the Student Awards starting were Gerald Knezek, KB5EWV, Robert Diersing, N5AHD, and Greg Jones, WD5IVD. They had wanted to do something like this for the last several years and found it possible now that the TAPR and ARRL conference have been joined. This made for a good opportunity and first round of results were very positive. Gerald and Robert will continue as co-chairs for the 1997 awards to be given at next years DCC. Full details on the 1997 Student Paper Awards are already available on the TAPR web site, under the DCC link.

Session 3a (1:30pm) began with the two Student Award Papers. "[Object-Oriented Modeling of a Satellite Tracking Software](#)" was presented by Marc Normandeau and his professor M. Barbeau, VE2BPM. This paper won the category of Best Technical/theory-oriented Student paper. Marc's paper presents a case study of an object-oriented development of a satellite tracking software. It is designed following the Real-Time Object-Oriented Modeling (ROOM) methodology. The design resulting from the application of ROOM is implemented in C++ on the QNX platform. The QNX kernel is about 15K and is really fast! ROOM yields a modular architecture which is clear, reusable, and maintainable. Use of QNX leads to a highly performant and reliable system. Excellent presentation!

Michelle Toon, KC5CGH , then presented the paper entitled "[Circus of the Stars](#)". This paper won the category of Best Educational or Community-Oriented Application Student paper. Michelle described a unique collaboration between diverse groups in the Waco, Texas, area. The project uses amateur radio to tie school sites in the Central Texas area together during a mentoring session based on night-time astronomical observation. Michelle discussed the issues of amateur radio in education and the project of involving schools with amateur radio during this summer project. Michelle told a great story of the trials and tribulation from the first introduction of the concepts of amateur radio in education from classes held by Gerald Knezek, KB5EWV, at the Univ of North Texas to her current efforts and projects in implementing various approaches. One of the best presentations during the conference.

Keith Sproul, WU2Z , then presented a paper by him and Mark Sproul, KB2ICI, entitled "[WinAPRS: Windows Automatic Position Reporting System. A Windows version of APRS](#)". WinAPRS is a Windows version of the popular APRS, Automatic Position Reporting System. WinAPRS is fully compatible with APRS, the DOS version, and the MacAPRS, the Macintosh version. Due to the larger amounts of memory available in the Windows operating system, WinAPRS, just like MacAPRS has many additional features not available in the DOS version. Keith discussed in detail some of the issues of supporting different OS software and how they have been able to do it easily.

Session 2b of the Introductory Topic session saw presentations by Glenn Elmore, N6GN, and Frank Perkins, WB5IPM. Glenn gave a presentation on High-Speed Networking which covered various topics in high speed digital communications. Glenn showed off what he has done the last several years as well as hit the high points regarding good network design and concepts. The session was well received. Frank Perkins presented a session on Satellite Communications. Due to a mix up, no one had been found to fill the slot of this talk, once it was known that the original speaker was not going to be able to attend. Armed with just blank overhead foils and a few pens, Frank, being a real trooper and an expert and user of amateur digital satellites, stepped right in and gave a very good talk. Frank covered the basics of getting on the digital satellites, talked a little about the upcoming Phase 3 D, discussed a little DSP, and answered a lot of questions from the audience about the topic. This session ended the Introductory sessions, which seemed to be very well received by those attending the different presentations.

Session 4 (3:30pm) was kicked off by a paper entitled "[javAPRS: Implementation of the APRS Protocols in Java](#)", presented by Steve Dimse, KO4HD. Steve's paper described an implementation of the Automatic Position Reporting Systems (APRS) protocols in the computer language known as Java. javAPRS extends the usefulness of APRS to the Internet and allows animation of APRS tracking data live over Java equipped systems. Steve used javAPRS during his trip from Florida to Washington to allow all those on APRS SIG and others to watch his progress. Very exciting stuff. There is a link to his Web page from the TAPR SIG web page.

Keith Sproul, WU2Z , presented his last paper of the day entitled "[Automatic Radio Direction Finding Using MacAPRS and WinAPRS](#)". Basically, Keith described how radio direction finding had been around for almost as long as radio itself and with the assistance of new Doppler-based RDF systems with computer

interfaces you could combine these elements under APRS. APRS now has the ability to display the RDF information on maps, giving the user a graphical way to view the RDF patterns. Using various CD-ROM databases and the like, tracking down potential jammers should be easy. Keith showed several examples to explain the concept and discussed some practical real stories. Keith felt that with all of the available technology, we should be able to develop a system that zeros in on a location and automatically shows us the possible transmitters in the area much simpler than many system have done in the past.

The last paper of the conference was presented by Phil Karn, KA9Q. Phil's presentation is not in the proceedings. Phil presented current information regarding his experimentation of coding and modulations on a PC. Some very exciting potentials Phil is seeing in this work. Everyone will need to listen to Phil's talk on the Internet to get all the details.

Dinner was held at 6pm. After dinner several Plaques were awarded. A plaque was given to Keith Justice, KF7TP, which read "TAPR Proudly Recognizes Keith Justice, KF7TP for outstanding service from 1993 to 1996 as a board member and Vice President from 1994 to 1995 of the Tucson Amateur Packet Radio Corporation." Another plaque was given to John Ackermann, AG9V, which read "TAPR Proudly Recognizes John Ackerman, AG9V, for outstanding service to TAPR as founder of the TAPR NETWORK Special Interest Group in 1994 and dedicated volunteer." Then several awards were given to the local hosts of the conference. "ARRL and TAPR are pleased to recognize, Steve Stroh, N8GNJ, and Tina Stroh for their invaluable and dedicated service as local coordinators for the 1996 ARRL and TAPR Digital Communications Conference". "ARRL and TAPR are pleased to recognize Puget Sound Amateur Radio TCP/IP Group for their participation as local co-hosts for the 1996 ARRL and TAPR Digital Communications Conference". "ARRL and TAPR are pleased to recognize Boeing Employees Amateur Radio Society for their participation as local co-hosts for the 1996 ARRL and TAPR Digital Communications Conference". One plaque of special note was given to Lori Wienberg , which read "ARRL and TAPR are pleased to recognize Lori Wienberg in appreciation for invaluable and dedicated service and support to the Digital Communication Conferences." Lori has been doing the conference proceedings from the very beginning. Everyone who has ever read or gotten a DCC proceedings owes a big thanks to Lori. Thanks Lori!

After the plaques were presented, Lyle Johnson, WA7GXD, gave his banquet talk. The talk was a real winner! The transcript will be printed in this issue of the PSR. Take a second and read it. You can also listen to Lyle's talk on the TAPR web site, under the DCC link on the TAPR Home Page. Lyle talked about the future of Amateur radio and gave some analogies that hit the mark one after the other. Everyone went away after the banquet thinking about where amateur radio is today and where it might be going.

After Dinner, several activies began. The TAPR HF SIG met, people gathered and held informal discussions in the hospitality area, and David Pederson, N7BHC, presented a slide show and talk on his work in getting digital communications set up in Africa.

At 8:30pm, TAPR's HF SIG met. Johan Forrer, KC7WW, began the SIG meeting with an introduction to SIG activities and a list of current goals for the SIG. Tom McDermott, N5EG, then presented an overview of the physical effects of HF ionospheric propagation, what their effects are on an HF signal, how you simulate these effects for a modem, and concluded with information on CCIR-520. This was a very good technical presentation and really hit a lot of the most important aspects of trying to build an HF simulator. Building an HF simulator has been a goal of the SIG over the last year. Johan then showed the HF simulator that had been developed based on the theory in Tom's presentation. The simulator was running on a TAPR/AMSAT DSP-93. Having a common simulator that the group can agree on has been deemed necessary in order to test and compare results for future HF digital communications designs. Johan discussed the development steps that had been done for the simulator. Johan then presented a talk on his current development of Quator. Quator is

Johan's research in developing a new robust HF digital modem. The presented materials looked very promising and everyone looks forward to seeing further development. The final discussion focused on the future of HF SIG.

Sunday, September 22nd, 1996

The first workshop on Sunday was by Dewayne Hendricks, WA8DZP. Dewayne's workshop focused on the aspects of using Part 15 wireless devices and their potential usage in Amateur Radio. Dewayne provided a laundry list of devices on the market currently and the audience took a lot of notes and asked a lot of questions about the different units. Dewayne outlined the planned introduction of two SS radios by TAPR (one at 115Kbps and another 256Kbps) in coming months as part of the ongoing Spread Spectrum rules changes in Washington. This workshop allowed those in attendance to grasp the reality and ease of implementation of truly high-speed amateur radios in the near future.

The second workshop on Sunday saw Barry McLarnon, VE3JF, provide an overview of what 56K is all about, including a survey of available hardware, networking design, and some hints 'n kinks based on 56K experience in the Ottawa area. Dennis Rosenauer, VE7BPE, followed with an entertaining and informative slide show on the 56K system which has been set up in the Vancouver area. Gwyn Reedy, W1BEL, contributed an update on current and future 56K - related products from PacComm. An array of 56K hardware was displayed and demonstrated, including two complete 56K stations based on PCs running Linux, provided by Dennis. The Linux boxes were networked to other PCs via SLIP and ethernet. Also on display were the new WA4DSY 56K modem, a Gracilis PackeTwin interface card, and the SPIRIT-2 PAD unit, all from PacComm, and an Ottawa PI2 card and Microwave Modules transverter from VE3JF. Everyone attending seemed to really enjoy the presentations and the ability to ask questions about the equipment at the end of the workshop.

Concluding Comments

The ARRL and TAPR Joint Conference Committee is now looking at sites for next year. The group has a proposal from NJ and MD to host next year's conference. There should be details as to next year's location by the first of 1997. Look for the ARRL and TAPR DCC on the East coast no matter what and to be held sometime the end of September! Until next year!

Proceedings:

Not everything published in the proceedings got presented at the conference. The following are the titles and authors for those papers that were not presented. The proceedings are now available from both [ARRL](#) and [TAPR](#) for \$12.00. [Full abstracts](#) are available on the TAPR web page (www.tapr.org). In addition, TAPR now has the complete set of proceedings available if you are missing any past issues.

Learning DSP by Porting Programs to the TAPR/AMSAT DSP-93 Modem
by John Bandy, W0UT
Linking BPQ Switches via Ethernet

by Bill Barnes, N3JIX

The Radio Amateur Digital System Artificial Intelligence Project

by Garry W. Joerger, N5USG

Fast Flow Control in High-Speed Communications Networks

by C.M. Kwan, R. Xu, and L. Haynes

Nonlinear Channel Equalization Using Fuzzy CMAC Neural Network

by C.M. Kwan, R. Xu, L. Haynes, and J.D. Pryor

Optimization of Phase-Locked Loops with Guaranteed Stability

by C.M. Kwan, H. Xu, C. Lin, and L. Haynes

Easy to Follow Packet

by James Nobis

XNET: A Graphical Look at Packet Radio Networks

by Richard Parry, W9IF

13cm PSK Transceiver for 1.2Mbit/s Packet Radio

by Matjaz Vidmar, S53MV

23cm PSK packet-radio RTX for 1.2Mbit/s user access

by Matjaz Vidmar, S53MV

The Word Storage Relay

by Pat West, W7EA

On-Air Measurements of HF Data Throughput Results and Reflections

by Ken Wickwire, KB1JY

On-air Measurements of MIL-STD-188-141A ALE Data Text Message Throughput over Short Links

by Ken Wickwire, KB1JY

The Technology Grows and Matures

by Bill Henry, K9GWT